

Academy Enhanced Terminal Voice Switch System Overview



June 22, 2005

Introduction

- **The Academy Enhanced Terminal Voice Switch (AETVS) system is comprised primarily of Commercial off the Shelf (COTS) products.**
- **The AETVS End User Interface (EUI) is similar to the fielded Terminal Voice Communication system called Enhanced Terminal Voice Switch (ETVS).**
- **The AETVS System is comprised of four different subsystems.**
 - **AETVS Digital Signal Processor (DSP) Subsystem**
 - **AETVS Communications (COM) Server Subsystem**
 - **AETVS Client Subsystem**
 - **AETVS Support Subsystem**
- **The primary method for communication between subsystems is Internet Protocol (IP) using Ethernet Local Area Networks (LAN)s and Cisco switching devices for connectivity.**

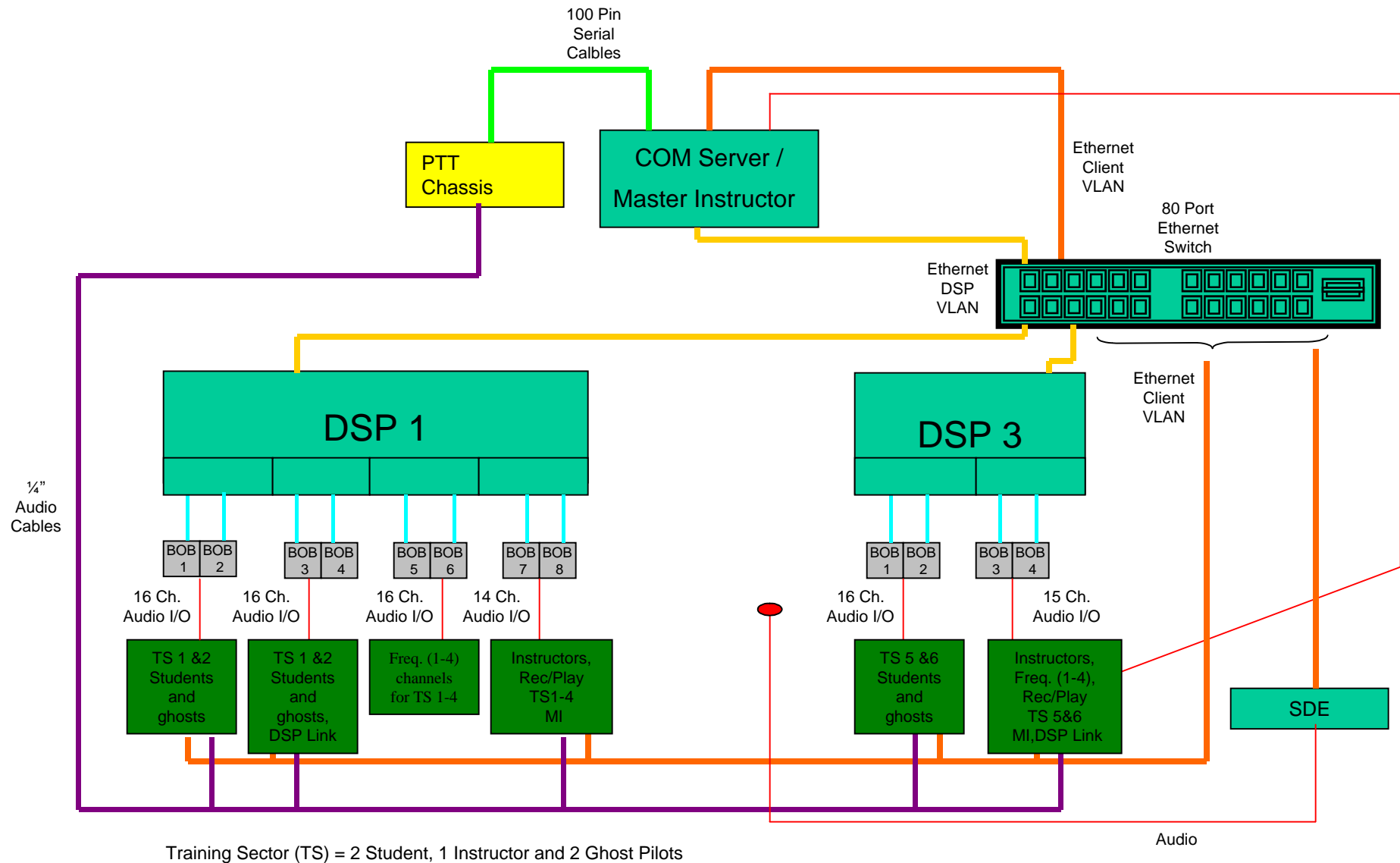


Introduction (Cont.)

- The AETVS is comprised of two laboratories (Lab A and Lab B).
- AETVS Labs are comprised of training sectors. Lab A and Lab B each have 6 Training Sectors (TS).
- Each TS is comprised of the following five client positions:
 - Two Student Controller positions
 - Two Ghost Pilot positions
 - One Instructor Position
- TS's within a Lab may be combined to form Training Groups (TG) in the following fashion:
 - TS1 + TS2 = TG1
 - TS3 + TS4 = TG2
 - TS5 + TS6 = TG3
- Training Sectors may be combined into their respective groups independent of Training Sectors in other groups
- There is one Communications Server and 2 Digital Signal Processors per Lab
- There is one Software Development Environment (SDE) Processor with connectivity to Lab A and Lab B



AETVS System Overview (1 of 2)

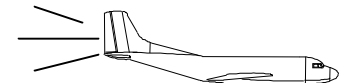
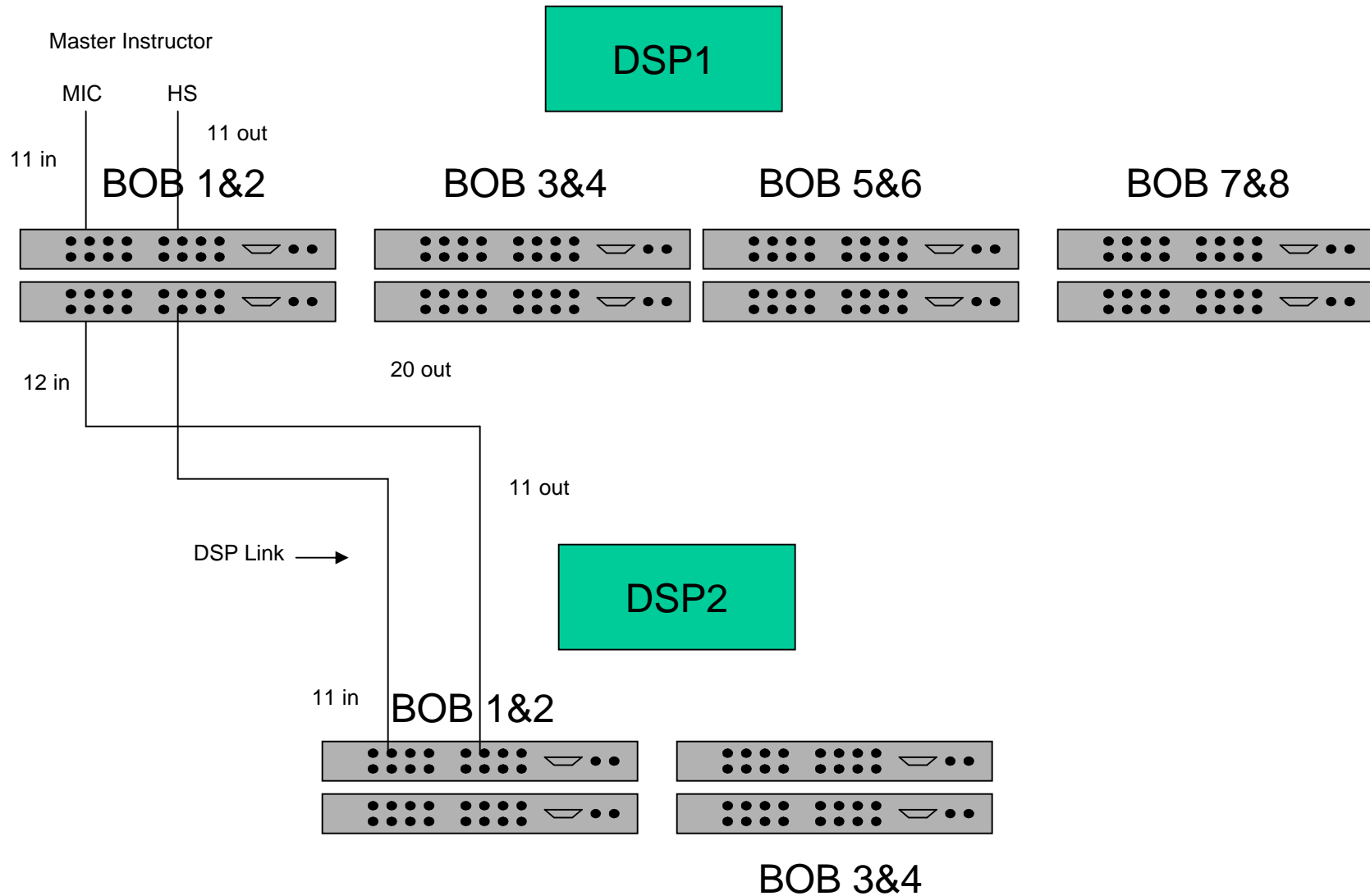


DSP Break Out Box and Audio Channel Configuration

- The following describes the channel requirements for the different audio components of the AETVS system:
 - Student and Ghost Pilot Positions – 2 Audio Channels
 - Instructor – 1 Audio Channel
 - Frequency Loop Back – 1 Audio Channel
 - Record/Playback – 1 Audio Channel
 - MI – 1 Audio Channel
 - DSP Link – 2 Audio Channels
- The each DSP Contains a configured amount of analog audio Break Out Boxes (BOBs). Each BOB supports analog audio for 8 channels (input/output). A 64 channel DSP contains 8 BOBs. A 32 channel DSP contains 4 BOBs.
- BOBs are wired in pairs (a master and a slave). The master and slave BOB are connected by Multimode Fiber.
- AETVS BOB pairs that contain Students and Ghost Pilots will split the BOB pair. The first 8 channels are allocated to the Student positions and the second 8 are allocated to the Ghost Pilots positions. This layout takes advantage of the distance capabilities of the fiber connection between the BOBs (~150 feet) to accommodate the distance between the Student and Ghost Pilot areas.



Master Instructor Broadcast and Monitoring



AETVS Push To Talk Chassis

- Each AETVS Lab requires one Push To Talk (PTT) Chassis
- The AETVS PTT Chassis is “semi” custom hardware that provides an interface from a Client (Student, Instructor, or Ghost Pilot) PTT Connector to the Communications Server for detection of user intent to talk on an audio line.
- The PTT Chassis interface from Client Positions is standard precut 1/4” audio cabling.
- The chassis interfaces to a digital/analog signal detector PCI card that is installed in the COM Server.
- This PCI card is made by National Instruments (Model - PCI-DIO-96). The card allows software applications to poll signals from 96 different sources.



AETVS Software



AETVS Software Overview

- AETVS Software is broken up into four categories
 - Communications (COM) Server software
 - Client software
 - DSP software
 - Support software
- COM Server software will be written completely in Microsoft Visual Basic using Visual Studio Version 6.0.
- Client software will be written completely in Microsoft Visual C++ using Visual Studio Version 6.0.
- DSP Software was developed using Simphonics V+ Visual Programming Language (VPL).
- Support software is written completely in Microsoft Visual Basic using Visual Studio Version 6.0.



Software Overview Cont.

- Additional COTS software licenses are as follows:
 - Ingenuware's Impulse Studio Active X modules for animated Labels (Client, Communication Server, and Support software).
 - Farpoint Technologies' Active X Enhanced Button modules (Client and Support software).
 - Global Majic Software (GMS) Slider controls (Client and Communication Server)

Communications Server Software Detail

- The AETVS COM Server software is the director for all audio routing within each of the AETV Training Sectors/Groups.
- The COM Server directs audio by sending a continuous data buffer via UDP (70 ms intervals) to each separate DSP within the Laboratory. The buffer provides configuration information regarding all audio routing that that particular DSP is responsible for.
- The COM Server communicates to all training sector position clients via TCP. Clients submit Audio routing requests that result in a change to the DSP UDP Data buffer, thus changing the analog audio input and output.
- The COM Server also polls the PTT Chassis I/O Card for PTT detection from all connected clients within the AETVS Lab.

Communications Server Software Detail (Cont.)

- Clients receive all information regarding their dialog adaptation (A/G and G/G Button adaptation) from the COM Server upon connection request. Dialog adaptation is delivered to clients based on Hostname/Computer Name which by convention should reflect the physical location of the client position.
- The AETVS COM Server software also manages current client connection states, Training Sector/Group adaptation configurations, and client software levels.
 - Any available Sector adaptation sets residing on the COM Server may be loaded to any Training Sector via COM Server software directives. Group adaptation sets may also be loaded.
 - Client executable updates may be distributed to each training sector via COM Server software directives.
 - Any/All Clients may be shutdown and restarted remotely via the COM Server/Client Remote Procedure Call (RPC) software.

Client Software Details

- The AETVS Client positions allow users at Student, Instructor, and Ghosts Pilot positions to set up the appropriate communication paths within an AETVS Training Sector or Group.
- Each Client Position connects to an AETVS COM Server via a TCP socket to submit audio routing requests.
- Upon initial connection acceptance, the client receives all associated A/G and G/G dialog adaptation from the COM Server.
- The Client provides the following audio routing functions
 - A/G Communication requests are submitted to the COM Server by selecting adapted A/G Frequency buttons
 - Separate XMT/RCV selections
 - Clients receive A/G Frequency XMT/RCV notifications from the COM Server and display them to the user (indicator color changes and flashing/fluttering)



Client Software Details (cont.)

- G/G Communication requests are submitted to the COM Server by selecting adapted G/G Direct Access (DA) buttons or by dialing a number the software Keypad. The following calls are available:
 - Interconference Calls (IC) (Any Position within a DSP)
 - Interphone Calling (IP) with call in-place and call in-use notifications and call join/leave capabilities
 - IP Direct Calls
 - IP Holler (Shout) Calls
 - Indirect Dial Calls (using the software Keypad)
 - Direct Access Calls
 - Voice Monitoring
- Call buttons may be configured to be Latching or Non-Latching.

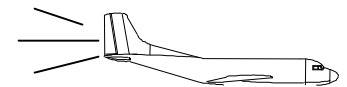
AETVS Client Application

UTILITY					SEL			IA DISPLAY CALLER ID		
120.20	TX SEL	RX SEL	TX MAIN	RX MAIN	HSLS	A/G HSLS	G/G HSLS		IA	
251.00	TX SEL	RX SEL	TX MAIN	RX MAIN	HOLD	CONF	ERAD PTT		CA	
119.50	TX SEL	RX SEL	TX MAIN	RX MAIN					RCON ENB	
252.50	TX SEL	RX SEL	TX MAIN	RX MAIN			AAC TWR		CALL FWD	
121.50	TX SEL	RX SEL	TX MAIN	RX MAIN	MLC AFSS	ZAE TUL	ZAE OKC	INST OVR	FREQ FWD	
243.00	TX SEL	RX SEL	TX MAIN	RX MAIN	JKE TWR	SGF APCH		MI OVR	KEY PAD	
A/G SUM	A/G2	A/G3	A/G4	A/G5	G/G1	G/G2	G/G3		REL	

RADIO PAGE 1 **G/G PAGE 1**



AETVS COM Server Application



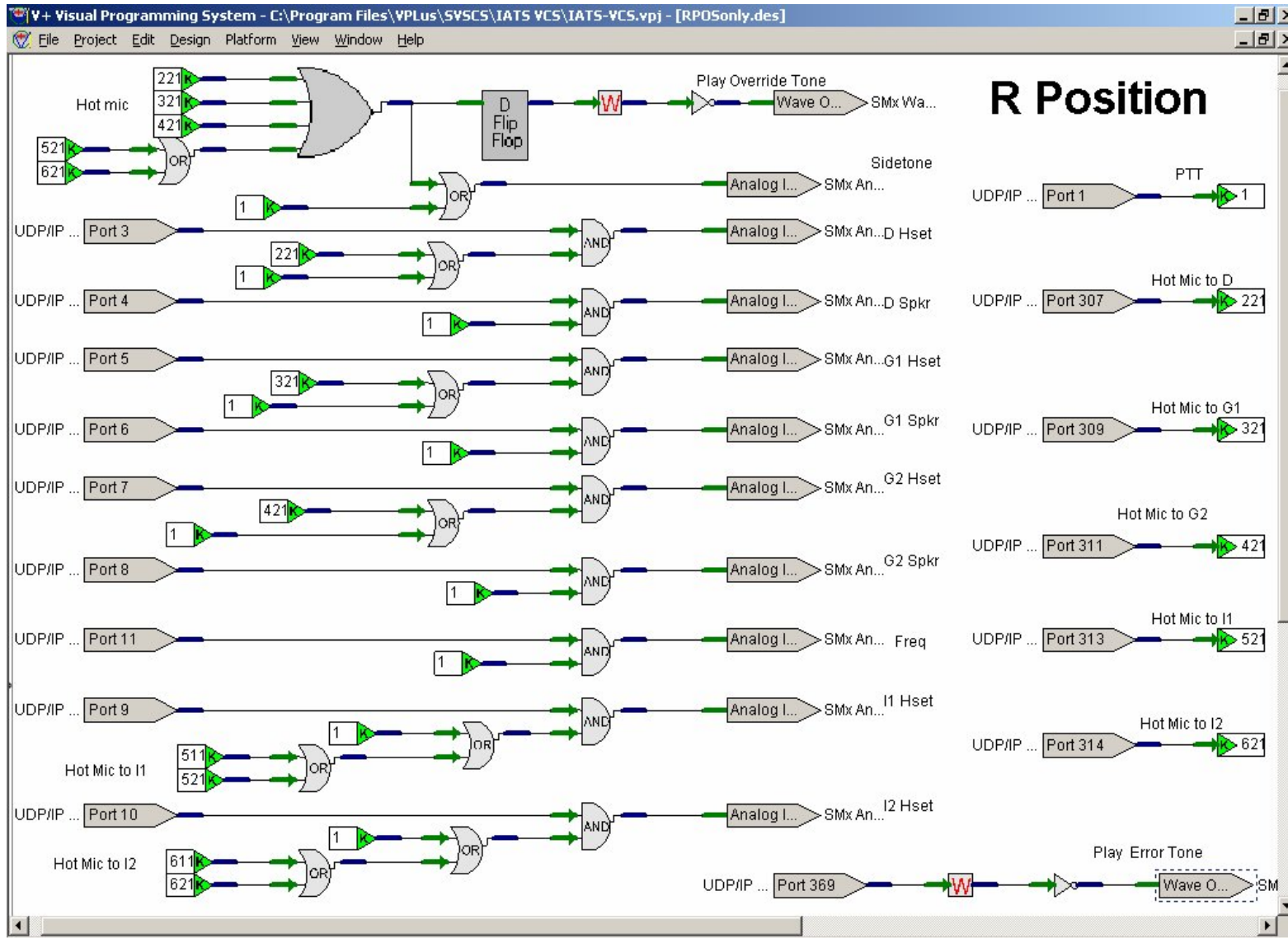
AETVS A/G Communication and Audio Routing

- The AETVS Training environment includes either 4 or 8 (Sector = 4; Group = 8) separate A/G frequency loop back channels.
- Any number of the frequency channels may be designated as emergency frequencies
- AETVS allows Audio output route switching of A/G frequencies between headset and loudspeaker for students and pilots
 - Switching is based on frequency channel (i.e. switching one frequency button allocated to frequency channel 1 will switch all frequencies buttons allocated to that channel)
 - Users may switch A/G audio routing using the Voice Routing switch on each individual frequency button and/or the HSLS switches (Master or AG switch)

DSP Software Details

- The AETVS DSP software is primarily configured COTS software
- Logic description sheets are created that describe audio routing logic based on bit settings contained within a byte buffer that is transmitted from the Communications Server
- Different logic can be triggered based on changes that occur within the data buffer being sent from the COM Server
- The DSP logic provides the following functions:
 - Wave (sound) file triggers (ring, zip(?) tone, etc...)
 - Audio Input and Output routing, activation, and deactivation
 - Audio Input Gain and Output Volume changes
- The DSP also provides a heartbeat to the COM Server via UDP for DSP failure notification

DSP Description Sheet Example



AETVS Client Adaptation Builder Software Details

- The AETVS Client Adaptation Builder software provides an interface to build and modify complete Training Sector and Training Group adaptation sets.
- Adaptation sets are retrieved/stored in a series of files organized within position folders. There is a position folder for each Training Sector and Training Group position. All position folders are stored within a top level folder which names the adaptation set.
- Adaptation sets may define a single training sector (5 positions) or a training group (10 positions).
- There are three files contained within a position folder.
 - AgConfig.txt
 - GgConfig.txt
 - PositionConfig.txt
- The Adaptation Builder interface allows the user to graphically define all A/G frequency buttons (30 frequency button sets) and all G/G buttons (54 G/G Buttons) for each position within an adaptation set.
- The Adaptation Builder also provides an user interface to build a dial (phone number) list for the adaptation set.

AETVS Client Adaptation Builder Software Details (Cont.)

- Adaptation sets can be saved and made available for loading to any Training Sector or Training Group using the COM Server
- Adaptation sets are maintained on both COM Servers (one per lab).
- At startup, the Adaptation Builder application allows the user to connect to either one of the two COM Servers (Lab A or Lab B).

AETVS Record/Playback

- AETVS provides audio input/output for a record and playback capability
 - Record/Playback Audio Channels are allocated for each student position.
 - Only headset audio is recorded (no loudspeaker) and playback of recorded signals cannot be switched to the loudspeaker
 - The Signal RecordEM software will be integrated into the IIF AETVS Test bed for record and playback of the student positions